

# Vegetation Response to An Ozark Woodland Spraying

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## Highlight

Aerial spraying of an Ozark woodland with 2,4,5-T temporarily increased yields of grasses preferred by cattle. Reinvasion of woody plants and heavy grazing by cattle contributed to a subsequent decline in yields of grass. The invading shrubs included many species preferred by deer.

Aerial spraying with chemicals to eliminate low-quality hardwoods has been practiced in Ozark uplands since the early 1950's. Benefits in terms of increased herbage have been reported by Dalrymple et al. (1964), Ehrenreich (1959), and Elwell (1964). While the main objective is to kill the hardwoods and thereby increase the growth of grass for livestock, the spraying also affects browse and forbs of value to deer.

This paper describes the vegetation changes that occurred between 1957 and 1964 on a sprayed and an adjacent unsprayed woodland in west-central Arkansas, near Paris. Preliminary results were reported by Crawford (1960).

In May 1957, 80 acres of a scrub-oak forest were sprayed with a low-volatile iso-octyl ester of 2,4,5-T. A mixture of 0.5 gal. 2,4,5-T (4 lb. acid equivalent/gal.), 1 gal. of diesel oil, and 3.5 gal. of water was applied at a rate of 5 gal./acre. The trees were mainly post and blackjack oaks (*Quercus stellata*, *Q. marilandica*). Soils were shallow, medium-textured, and stony.

Grass, forb, and browse yields were sampled by clipping and weighing the available growth of the current season and making adjustments for estimated utilization. Samples were from

randomly located plots 3.1 ft.<sup>2</sup> and 5 ft. high. Eighty plots were in the sprayed and 40 in the 40-acre unsprayed woodland.

Cattle were excluded from the sprayed area in 1957 and 1958; 20 cows grazed for 7 months in the winter of 1959-1960 and were then removed. The same number of cows was returned to the area in August 1960, and 10 to 20 head grazed intermittently as forage was available, mainly in spring and summer, through 1964. The unsprayed woodland was ungrazed.

Annual rainfall from 1957 through 1964 is summarized in Table 1. The data are from Weather Bureau records at Booneville, 4.5 miles southeast of the study area.

## Results

**Tree Defoliation and Mortality.**—Spraying caused most of the leaves to wither and fall. Some dead leaves remained on the trees through the growing season, but the defoliation was considered good for a single application. Though most trees appeared to be dead or dying in early summer, sprouting along the main stem and branches was

Table 1. Inches of annual rainfall at Booneville, Arkansas, 1957-1964.

Year	Precipitation
1957	68
1958	48
1959	45
1960	46
1961	50
1962	40
1963	26
1964	38
Longtime annual avg.	45

common by October (Fig. 1). New laterals sprouted in the spring of 1958 (Fig. 2), but most died during the summer. By September 1958, 88% of the trees in the 8-12 inch d.b.h. class and 97% in the 3-7 inch class were largely bare of leaves. Some trees partially recovered in subsequent years, and by 1962 brushy regrowth of oak was prevalent over much of the tract. In 1964 nearly all surviving trees had reduced crowns, and 73% of the smaller trees (3-7 inches in diameter at breast height) and more than 80% of the larger trees were dead (Table 2).

**Grass.**—Grass yields on the sprayed woodland were greater than on the unsprayed the first growing season following treatment, but the big difference came the second year (Table 3), when the sprayed woodland yielded approximately 555 lb/acre more air-dry grass than the unsprayed. Yields of the preferred grasses, little bluestem

Table 2. Condition of trees eight growing seasons after being sprayed with 2,4,5-T.

Diam. class	Dead		Alive	
			Visibly affected by spray	No visible effects of spray
Inches	—	—	Percent	—
3-7	73	18	9	
8-12	80	20	0	
12 +	88	12	0	

Table 3. Grass yields in lb/acre, air-dry.

Grass classification	1957	1958	1960	1964
Sprayed woodland				
Preferred	274	411	300	2
Non-preferred	290	464	360	164
Total	564	875	660	166
Unsprayed woodland				
Preferred	135	36	12	3
Non-preferred	300	284	63	56
Total	435	320	75	59

(*Andropogon scoparius*), big bluestem (*Andropogon gerardi*), and Indiangrass (*Sorghastrum nutans*) were 375 lb. greater on the sprayed woodland than on the unsprayed. These species are the most important native forage grasses in the Ozarks, and cattle grazing capacity should be based primarily on their yields.

The improved grazing values implied by these data are corroborated by Davis (1960), who measured beef yield of herds on sprayed and unsprayed Ozark forest range. In the second year after the spraying, beef production was 14 lb/acre on sprayed range, 0 on unsprayed.

Yields of preferred grass on the sprayed woodland exceeded those on the unsprayed woodland through the summer of 1960—a period when cattle grazing was either light or nonexistent and the annual rainfall was normal or above. Beginning in late August 1960 and continuing through 1964, utilization of the preferred grasses by cattle was very heavy. As a result of this close grazing in combination with an increase in brush and below-average rainfall from 1962 through 1964, the yields of preferred grasses fell to practically nothing. Thus, in somewhat less than 8 years after spraying, during the last 5 of which grazing was heavy, the total grass forage had declined greatly, and consisted almost entirely of low-value species such as broomsedge (*Andropogon virginicus*), panicums (*Panicum* spp.), poverty oatgrass (*Danthonia spicata*), threeawns (*Aristida* spp.), and sedges (*Carex* spp.).

Under the conditions of this study, periodic respraying at less than 8-year intervals and grazing at rates calculated to remove 40% or less of yields of desirable forage grasses would likely have lengthened the years of productivity for the preferred species.

Abundant rainfall—23 inches



FIGURE 1. Four months after a May 1957 spray, many leaves were withered or fallen, sprouting from dormant buds (feathering) was evident, grass had lived up, but forbs were scarce.



FIGURE 2. In September 1958, sixteen months after spraying, trees were largely leafless but many were alive, grass growth was prolific, horseweed and fireweed were abundant.

above normal for the year—was probably responsible for the heavy grass growth on the unsprayed area in 1957. With less

rainfall in following years, grass yields declined to a low in 1964, when annual rainfall was 7 inches below normal. Except in

1957 the unsprayed area was practically devoid of preferred grasses.

**Forbs.**—For the first two growing seasons the yields of forbs preferred by cattle and deer were slightly less than on the unsprayed woodland, but thereafter little or no difference existed between areas (Table 4). The main forb species were lespedezas (*Lespedeza* spp.), tick-clover (*Desmodium* spp.), goat's-rue (*Tephrosia virginiana*), pussytoes (*Antennaria plantaginifolia*), asters (*Aster* spp.), prickly lettuce (*Lactuca* spp.), and goldenrod (*Solidago* spp.).

Two species noticeably altered the forb complex on the sprayed area for a few years. Horsetweed (*Erigeron canadensis*) and fireweed (*Erechtites* spp.), sparse in 1957, flourished in 1958, yields being 558 lb/acre. Their dominance was shortlived, however, for by 1962 their yields were less than 50 lb/acre. Their large yields in 1958 had little effect on grazing values, for they are essentially unused by cattle or deer, even under stress conditions.

With forbs, as with grasses, the heavy yields on the unsprayed area in 1957 were largely attributable to abnormally high rainfall.

**Browse.**—The spray defoliated and killed most of the understory browse plants not overtopped by trees.

Browse yields were less than half that of the unsprayed woodland in 1957 (Table 5). With release from overhead competition, browse plants increased each year and by 1964 formed an almost complete low cover (Fig. 3). More than half the increase was in non-preferred species, but the yield of preferred browse in 1964 was six times that in unsprayed woods.

In terms of preferred deer browse the spray was beneficial and up through 1964 there was

**Table 4. Forb yields in lb/acre, air-dry.**

Forb classification	1957	1958	1960	1962	1964
Sprayed woodland					
Preferred	25	85	70	30	41
Non-preferred	75	630	145	35	15
Total	100	715	215	65	56
Unsprayed woodland					
Preferred	65	100	70	40	44
Non-preferred	210	20	20	5	22
Total	275	120	90	45	66

**Table 5. Browse yields in lb/acre, air-dry.**

Browse classification	1957	1958	1960	1962	1964
Sprayed woodland					
Preferred	25	20	120	115	235
Non-preferred	75	260	450	500	430
Total	100	280	570	615	665
Unsprayed woodland					
Preferred	45	35	40	75	35
Non-preferred	330	240	645	365	200
Total	375	275	685	440	235

no indication of a need for respraying.

The main species in this group were flamel leaf sumac (*Rhus copallina*), blackberries (*Rubus* spp.), common deerberry (*Vaccinium stamineum*), grape (*Vitis* spp.), sensitive brier (*Schrankia nuttallii*), and greenbriers (*Smilax* spp.). Blackjack and post oaks and hickory (*Carya* spp.) were highest yielders among nonpreferred browse species.

The increase in these preferred deer browse species must, of course, be weighed against the virtual elimination of acorns, a favorite food of deer. In this study there was no way to evaluate the overall effects on deer food supply. Leaving unsprayed strips or blocks of acorn-producing oaks might provide a desir-



**FIGURE 3.** Eight growing seasons after the spraying, a low, dense cover of browse and young trees dominated. Grass yields were low.

able diversity of habitat. Edge effect would be increased, and release of oaks along the edges should stimulate acorn production. Over the years the development of several successional stages of vegetation would insure a near-optimum variety of food.

#### Conclusion

If, as is usually the case, the purpose of spraying Ozark woodlands is to improve cattle forage, then respraying at less than 8-year intervals is suggested. Preferred grasses should be grazed moderately. If deer habitat is the main consideration, spraying should be less frequent and in alternate strips or small blocks.

#### LITERATURE CITED

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